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From: David L. Garrison   
Date: September 8, 2005  
Serial No. 10/821,065

Our Ref. No.: GOR101

Total Number of Pages, Including This Cover Page: 12

MESSAGE: Petition to Make Special (37 CFR 1.102(b) and MPEP § 708.02(XI)).

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VIA FACSIMILE (571-273-8300)

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

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Applicant(s): William Gordon

Filing Date: 4/8/04

Title: REBREATHING APPARATUS

Group Art: 3743

Serial No.: 10/821,065

Examiner: T. K. Mitchell

Docket No.: GOR101

Date: September 8, 2005

Commissioner for Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

09/09/2005 TL0111 00000009 10021065

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130.00 OP

PETITION TO MAKE SPECIAL  
(37 CFR 1.102(b) AND MPEP § 708.02(XI))

Applicant hereby petitions to make this application special and request that the subject application be advanced out of turn for examination.

Applicant's invention is currently being tested by the U. S. Department of Homeland Security as a device which finds use in countering terrorism. The invention relates to a rebreather apparatus for underwater diving, and is particularly useful in enhancing the underwater capabilities of divers such as a SEAL team and aiding significantly to the period of time in which the user can function effectively under water. A copy of the document entitled "Unclassified Requirements for the AT-UBA ORD Revision 2 dated 14 April 2004 is attached, showing the testing protocol currently underway in the U. S. Department of Homeland Security on the devices disclosed and claimed in this application.

## CERTIFICATE OF MAILING

I hereby certify that this correspondence (and any correspondence being indicated as attached or enclosed) is being sent via Facsimile to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

on September 8, 2005  
Date  
SignatureSusan J. Hiles  
Name of person signing certificate

Docket No.: GOR101

A Pctition Fee pursuant to § 1.17(h) in the amount of \$130.00 is enclosed.

Please charge any deficit or credit any excess fees to our Deposit Account No. 50-0684.

Please send all notices and correspondence to David L. Garrison, an attorney identified in the Combined Declaration and Power of Attorney filed with the above referenced application.

Expedited prosecution is respectfully solicited.

Respectfully Submitted,

*Garrison & Associates PS*



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**Unclassified Requirements  
for the  
AT-UBA ORD Revision 2  
(14 April 2004)**

**1. General Description of Overall Operational Capabilities.**

a. Definitions. For the purpose of clarity, definitions of the types of diving systems used in special operations are provided below.

(1) Open Circuit. A system that uses diver's quality compressed air which vents the diver's exhausted gas to the surrounding environment.

(2) Semi-closed Circuit. A mixed-gas system that uses a preset flow rate to control the oxygen concentration in the system. This system recirculates breathable gases. Nonconsumable carbon dioxide exhausted by the diver is contained by a chemical absorber. A continuous flow of gas ensures a sufficient concentration of oxygen in the system. The continuous flow of gas requires that excess volume be vented to the surrounding environment.

(3) Closed Circuit. There are two basic types of closed circuit systems, mixed-gas, and pure oxygen (also referred to as fully-closed circuit).

(a) Mixed-gas Closed Circuit. A mixed-gas system that monitors and controls the oxygen concentration in the system automatically mixing the gas for optimum safety and performance as a diver's depth changes. This system recirculates breathable gases. Carbon dioxide exhausted by the diver is contained by a chemical absorber. During diver descent, and while at depth, this system fully contains all gases. However, during diver ascent, the use of inert nonconsumable, nonabsorbable gases requires venting of the expanding, excess gas volume to the surrounding environment as the atmospheric pressure decreases.

(b) Fully-closed (pure oxygen) Circuit. A system that uses pure oxygen as the breathing medium, recirculating the gas until it is metabolically consumed by the diver. Inert gases must be purged from the diver/system breathing loop at the beginning of the dive. Carbon dioxide exhausted by the diver is contained by a chemical absorber. The use of pure oxygen permits a diver to ascend to the surface at a rate equal to gas metabolic consumption to preclude venting any gases to the surrounding environment. An ascent rate faster than the diver's metabolic consumption rate will result in the expanding volume of gas venting to the surrounding environment as it exceeds the capacity of the system.

b. Proposed System. The AT-UBA is a tactical multi-mode diving apparatus that will replace the Mk 16 UBA currently used by the SDV pilot and navigator. The AT-UBA will also be used for undersea combatant swimmer operations when deep water lock-out/in precludes the use of the Mk 25 fully-closed circuit UBA. The AT-UBA will employ advanced technology design that enhances Naval Special Warfare's diving capability.

(1) Desired AT-UBA characteristics:

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Enclosure (2)

- Compact and lightweight
- Back-mounted and un-tethered
- Open circuit capability (using external gas supply), with an emergency manual override in the event of a flooded breathing loop
- Mixed-gas Closed circuit capability
- Fully-closed circuit mode to permit diver control of off-gassing
- Sensor subsystem for life support monitoring.
- Fully interface with full-face mask.
- Compatible with ANU approved equipment to include lifejacket/or new buoyancy compensator
- Standby mode
- Compatible with SDV, ASDS and/or diver communications systems (Both SDV intercom and combatant swimmer through water systems)

(2) Specific Mission. The AT-UBA will be used by SEAL, SDV pilots and navigators, and by SEAL combatant swimmers operating from the ASDS at lock-out/in depths beyond the capability of the Mk 25 fully-closed circuit UBA. Other SOF or attached mission personnel may employ the same diving apparatus.

2. **Capabilities Required.** Performance specifications and characteristics of the AT-UBA are provided below. Key Performance Parameters are identified by (KPP) and represent essential system capabilities that if not met may warrant consideration for program cancellation. A quick reference of required capabilities is provided as Table 1.

a. **System Performance.** The basic system performance parameters discussed in the following sub-paragraphs.

(1) Dive Depths. The AT-UBA shall be capable of dive depths from 0 to 110 FSW (T), and should be capable of dive depths from 0 to 190 FSW (O). The AT-UBA should be capable of operating to the threshold maximum depth to the surface without impacting other system capabilities.

(2) (U) Dive Duration. Without an augmenting auxiliary system, the AT-UBA shall be capable of supporting a closed circuit 6 hour dive at 20 FSW in temperatures > 40° Fahrenheit at 20 liters per minute (lpm) Respiratory Minute Volume (RMV) for 4 hours and 36 lpm RMV for 2 hours (T); support a closed circuit 8 hour dive at 66 FSW in temperatures > 40° Fahrenheit at 20 liters per minute (lpm) Respiratory Minute Volume (RMV) for 6 hours and 36 lpm RMV for 2 hours (O).

(a) (U) The system must be capable of supporting a 4 hour dive in the fully-closed circuit (unaugmented) mode at 20 FSW in temperatures > 40° Fahrenheit at 22 lpm RMV for 2 hours, and 36 lpm RMV for 2 hours (T); support a 6 hour dive in the fully-closed circuit (unaugmented) mode at 20 FSW in temperatures > 40° Fahrenheit at 22 lpm RMV for 4 hours and 36 lpm RMV for 2 hours (O).

(b) The AT-UBA shall be capable of supporting a 12 hour mission in a ready-to-dive mode at 30 FSW at temperatures > 50° Fahrenheit (T). UBA must be on and ready to dive for 12 hours (6 hours in use, 6 hours in standby while submerged).

(3) Off-Gassing Control. The system must have the capability to not off-gas during selected parts of the mission. System may be designed so that some off-gassing is acceptable but control of any off-gassing shall be the diver (T), and/or UBA controlled, or non-visible off-gassing (O).

(4) Noise Emissions. The design shall minimize (T), or eliminate (O), noise emissions. The Mk-16 UBA uses an electric solenoid to add gas to the breathing loop that produces an easily noticeable audible "click" when it actuates. The intent is to incorporate technology design that will eliminate or greatly reduce blatant noise emissions like the solenoid.

(5) Descent Rate. The system must support a diver descent rate of 150 feet per minute for 5 seconds without disrupting the diver's breathing (T).

(6) System Weight in Air. Weight < 70 lbs (T), Weight < 30 lbs (O). (Note: System weight shall be measured with UBA in dive ready configuration to include fully packed canister, and bottles charged.).

(7) System Buoyancy. Neutrally buoyant in seawater (T), neutrally buoyant in both freshwater and seawater (O). (Note: System buoyancy shall be measured with UBA in dive ready configuration to include fully packed canister, and bottles charged. Limited use of counter weights to attain neutral buoyancy is acceptable.)

(8) T-Bit Mouthpiece/Full-Face Mask (FFM). The AT-UBA will include a T-Bit mouthpiece and be equipped with or compatible with an ANU approved full-face mask. (T).

(9) Diver's Attitude in the Water. The AT-UBA must provide a consistent and predictable gas-flow to the diver regardless of diver's attitude in the water column (T). The water column is defined as: from the water's surface to the maximum operational depth.

(10) Interoperability. The AT-UBA will be fully compatible with current SDV onboard communication systems using the full-face mask or T-Bit mouthpiece (T).

(11) Gas Control System. Gas control system operation must be controllable by the diver at all times and include manual override control options for all gas bottles (T).

(12) Display(s) / Control(s). Critical subsystems must be able to be monitored, and controlled, if applicable, by the diver. Subsystem displays will include at a minimum: all gas bottle pressures, ppO<sub>2</sub> level readings, and battery status (T). If the UBA is equipped with an integrated dive computer, all dive related information shall also be displayed (T). The display(s)/control(s) must be easily accessible for reading by the diver, and dive partner from either side, unencumbering, and shall not present any undue snag hazard for the diver (T). A primary display shall provide overall system status, and a secondary display shall provide gas

bottle pressures, and sensor data. Sensor data will be readable in a cyclic mode, or simultaneous and averaged displays (T). Displays shall have independent power sources (T).

(13) Dive Setup Time. The UBA pre-dive setup time shall not exceed 1 hour (T), not exceed 30 minutes (O).

(14) Standby Capability. The system shall permit placement into a standby mode after pre-dive is completed for a period of 96 hours without impacting the dive duration or "readiness for dive" capabilities (T), for up to 7 days (O). Requirement assumes air temperature range from 35°- 104° Fahrenheit. If a power off/on switch is required it will be designed to preclude inadvertent actuation by the diver or his surroundings.

(15) Battery. The AT-UBA shall use readily available commercial-off-the-shelf (COTS) batteries (T), or COTS rechargeable batteries (O).

b. Logistics and Readiness.

(1) Operational Mission Failure. An operational mission failure is defined as a failure that prevents an item from performing its required mission critical functions, i.e. life support for a UBA.

(2) Operational Reliability.

(a) Reliability: Mean Time Between Operational Mission Failure (MTBOMF). The AT-UBA shall have a MTBOMF of 98 hours (T), 220 hours (O). (Based on a 6 hour mission and equates to a reliability of 0.94 (T), and 0.973 (O) (KPP).

(b) Maintainability: Mean Corrective Maintenance Time for Operational Mission Failure (MCMTOMF). The AT-UBA shall have a MCMTOMF of 1 hour (T), 0.5 hour (O).

(c) Availability: The AT-UBA shall have an Operational Availability ( $A_o$ ) of 0.90 (O). (Calculated using an MTBOMF of 220 hours, an MCMTOMF of 0.5 hours, and a Mean Logistics Delay Time (MLDT) of 24 hours).

(3) Maintenance Concept. Scheduled maintenance will consist of cleaning, inspection, and replacement of high wear items, e.g. changing the batteries, o-rings, absorbent canister dust filters, etc. Depending on the item, maintenance can occur as often as every dive. Steps should be taken to eliminate frequent and unnecessary maintenance. The standard pre-dive and post-dive inspection and maintenance procedures will be taken into account when developing a maintenance program.

(a) Repair capability will be accomplished using the same support established in the logistics plans presently in use for NSW diving equipment.

(b) No increase in maintenance manpower or change in skill levels is desired.

c. Environmental, Safety and Occupational Health (ESOH) and Other System Characteristics

(1) Electronic Attack and Wartime Reserve Modes. Not applicable.

(2) Chemical, Biological, and Radiological (CBR) Survivability. The AT-UBA may be exposed to a CBR contaminated environment and if exposed, must continue to function reliably without degradation of system capabilities.

(3) Natural Environmental Factors. The AT-UBA must function reliably without any degradation in performance or capability after exposure to all NSW operational environmental conditions, which include, but are not limited to: high and low temperature extremes to include temperature shock (hot air to cold water/cold air to hot water), mechanical shock, vibration, sea spray, rain, and sun.

(4) Safety parameters.

(a) The AT-UBA will not present any undue safety hazards to the diver, both in design and function, beyond those normally associated with diving.

(b) The AT-UBA must include a means for the diver to avoid or minimize inhaling or ingesting caustic substances in the event of a catastrophic failure of seals.

(c) The AT-UBA operations manual and initial training will include diver emergency action procedures in the event of system full or partial failure.

(d) Anti-Snag Design. The AT-UBA system controls and gauges must be designed so as to not create any undue snag hazard that will hinder routine or emergency egress of the diver from the SDV, ASDS, or DDS.

(e) Logistics Compatibility. All AT-UBA components and materials (i.e. battery, CO<sub>2</sub> absorbent chemicals, and lubricants) shall be permissible for storage, maintenance, and use aboard the DDS, ASDS, and U.S. Navy submarines (KPP).

(f) Storage Temperature. The AT-UBA will be exposed to temperature extremes during transits and storage and must be capable, without degradation of materials or operational performance, of withstanding temperatures ranging on average from -24° to 120° Fahrenheit (T), and -40° to 150° Fahrenheit (O).

(5) Hazards of Electromagnetic Radiation to Ordnance (HERO). The AT-UBA will be operated in the presence of electric explosive devices and must not cause any HERO risks after pre-dive is completed and during all phases of a tactical mission (T). The system should not cause any HERO risks during pre-dive, post-dive and planned maintenance procedures (O). Should any HERO risk exist during these procedures, they will be well documented with proper safety warnings and cautions noted in the appropriate documentation (KPP).

(6) Expected Environmental Mission Capability.



(a) Operational Temperature. The AT-UBA must be capable of operations in all water temperatures ranging from 29°-105° Fahrenheit (T).

(b) Material Off-Gassing under Pressure. The AT-UBA will meet all material off-gassing requirements for use aboard the DDS, ASDS, and U.S. Navy submarines (KPP).

(c) Operational Clothing. The AT-UBA must be fully operable with divers wearing extreme cold-water protective clothing and tactical operational equipment (T).

(d) Display(s) / Control(s) Readability. All AT-UBA gauges and displays must be readable by the diver in both day and night conditions and must be shielded or otherwise controllable to avoid causing night blindness (T). They must also be easily concealable by the diver to preclude detection and possible compromise by surface observers (T). Testing must assume ideal water clarity and visibility conditions with no ambient natural light (e.g. new moon, no cloud overcast condition, etc.).

(7) Physical and Operational Security. The AT-UBA is an unclassified system, and requires no security provisions other than security from theft or sabotage.

### 3. Program Support.

a. Maintenance Planning. A standardized maintenance plan will be developed for the AT-UBA. System maintenance will be conducted at the organizational level and/or at the depot level as appropriate.

b. Support Equipment. It is anticipated that the AT-UBA will not require any unique support equipment. In the event unique support equipment is required, e.g. computerized system testing equipment and specialized tools, the unique support equipment will be provided to the users as a part of the system. The basis of issue plan for any special tools will be determined when identified.

#### c. C4I/Standardization, Interoperability, and Commonality.

(1) C4I. Not applicable.

(2) Standardization, Interoperability, and Commonality.

(a) The AT-UBA must be fully interoperable with the SDV, DDS, ASDS, and from U.S. Navy submarines (KPP).

(b) The AT-UBA system parts shall be standardized and interchangeable between systems if required.

(c) The AT-UBA system must be equipped and/or compatible with equipment tested separately and Approved for Navy Use (ANU) to include life preservers and other standard issue

ANU approved equipment.

(d) The system battery (batteries) must be compatible for use aboard the SDV, DDS, ASDS, and storage and routine maintenance (e.g. recharging) inside the pressure hull of U.S. Navy submarines.

d. Computer Resources. If the AT-UBA utilizes an electronic control subsystem, computerized test, evaluation, and troubleshooting equipment shall be required.

c. Human Systems Integration

(1) Integrated Logistical Support (ILS). The AT-UBA will be operated and maintained by personnel organic to NSW component commands. The logistics support and maintenance for the system will be performed by current NSW logistical support organizational structures. The supply support system must provide for the timely acquisition, distribution, provisioning, and inventory replenishment of all system components, spares, repair parts, and consumable supplies necessary to maintain and operate the system. Supply and maintenance planning will be closely coordinated with all phases of system acquisition. This information and information obtained during testing of the AT-UBA will be used to determine initial stock at all levels of supply.

(a) It is anticipated that program planning for ILS support will use an IPT management team with all appropriate element managers participating. It is also anticipated that the documentation required to support this system will include, but not be limited to, the following:

- Level of repair analysis
- Failure modes effects and criticality analysis
- System safety program plan
- Provisioning parts list
- Maintenance plan

Note: All of the above documents will be utilized in the development of operations, maintenance, training manuals, and training material as required, to support the system.

(2) Training Concept. The manufacturer will provide initial operator and maintainer training to critical NSW personnel who will in turn perform as subject matter experts and provide training to the remainder of NSW personnel following a Train-the-Trainer concept. The standard training program will involve basic system training by the user commands.

(3) No additional manpower or skill level is anticipated.

f. Other Logistics and Facilities Considerations. Configuration management, reliability and maintainability, safety, quality assurance and quality control procedures will be integrated with total ILS development. A configuration management plan will be developed including a product baseline; configuration status accounting system; allocated, physical and functional audits; and engineering change proposals. Related ILS elements, efforts and documentation will include reliability and maintainability (R&M) predictions, system safety program plans; quality

assurance plan, and hazard analysis.

(1) The ILS plan will include strategy, procedures and schedules for all technical data related to the program. The program will be CALS compliant. All documentation developed for this program will be tailored to meet the specific needs of the program.

g. Transportation and Basing. No additional transportation or basing requirements are anticipated.

h. Geospatial Information and Services. Not applicable.

i. Natural Environmental Support. The proper procedures and regulations for disposal of any hazardous waste associated with the AT-UBA will be identified in the support documentation.

4. Force Structure. Total requirement is for 153 systems to support operational, training, and spares.

5. Schedule.

a. Initial Operational Capability (IOC). IOC will be obtained when:

- 40 AT-UBAs have been delivered and accepted (20 systems each to SDV Team ONE and SDV Team TWO).
- Tiger Team training has been completed and the training and O&M manuals have been delivered and accepted.
- ILS is in place and functional.

b. Full Operational Capability (FOC). FOC will be obtained when:

- The full allotment of systems has been delivered and accepted.